A MODEL OF BURNS IN RABBITS WITH ISOLATED HEATING OF THE SKIN

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[Following is a translation of an article by N. I. Kochetygov in the Russian-language journal Patologicheskaya Fiziologiya i Eksperimental'naya Terapiya (Pathological Physiology and Experimental Therapy), No 3, 1963, p 74.]

From the Military Medical Order of Lenin Academy imeni S. M. Kirov

A study of various burns in experiments on dogs, cats, rabbits, and white rats (more than 500 animals) convinced us that the outcomes of thermal trauma are determined not only by the area but also by the intensity of the skin lesion as well as by the depth and intensity of heating of the subcutaneous tissues.

Burns with different degrees of heating of the skin (for example, from the effect of a flame or from hot water) are distinguished, in addition, by different depths of penetration of the heat into the subcutaneous tissues. The greater the skin temperature was at the time of the burn the more heat could penetrate into the subcutaneous tissues. Because of this, it is hard to determine to what degree the course of the burns depends on the intensity of heating of the skin, on the one hand, or the depth of involvement of the underlying tissues, on the other. Models of severe burns used in the majority of experimental studies are characterized by heating of skin and muscles. However, in man the involvement of muscles in burns is exceedingly rarely observed [1].

Considering the considerations presented, we used a model of burns in rabbits with isolated heating of the skin of the trunk. The muscles were protected against the heat by introduction of air under the skin. In experiments on rats this technique has been used previously [2].

As is well known, in rabbits there is a layer of cutaneous musculature in the split sheet of superficial fascia which moves the skin. The skin (with the cutaneous muscles) is readily mobile, and when air is injected through an injection needle the skin readily separates from the skeletal muscles over the entire trunk. For this it is enough to inject 700-800 cc of air through two punctures (on the back and on the abdomen).

After the creation of the air padding the infliction of the burn is not accompanied by heating of the skeletal muscles. Even when the skin temperature is raised to 80-85° (thermometric data with needle thermocouples)

the temperature on the surface of the muscles does not go go up more than 2-3°. After the infliction of the burn and the normalization of the skin temperature the air is aspirated. The experiments on healthy rabbits showed that not only a single but even regular (for a month) injection of air subcutaneously does not in itself cause appreciable general changes in animals and does not interfere with the blood supply of the skin.

With the use of air protection of the muscles, we inflicted the burns by different methods: with hot water, steam, as well as by thermal radiation from a special apparatus proposed in our laboratory. Before the burn was inflicted the skin was depilated.

Different variants of the experiments on 95 rabbits made it possible to determine that in burns of 15-20 percent of the body surface the model of a severe burn with a fatal result on the first day can be obtained only from simultaneous heating of skeletal muscles. When only the skin is involved the majority of the animals dies later, mainly during the period between the 10th and 60th days, and some of the animals survive.

Burns of 30-35 percent of the body surface with isolated heating of the skin to 50-55° provide for the creation of a model of thermal trauma with pronounced plasma loss and hemoconcentration. By means of weighing the affected skin and comparing it with the weight of skin taken from the same area of healthy rabbits, it was determined that in this type of burn 50-80 percent of the entire plasma volume is lost in the area of the trauma. In contrast to this, burns of the same area but with heating of the skin to 65° or more occur without essential plasma loss or hemoconcentration. However, in the former case recovery of the animals is possible; in the latter, the trauma terminates fatally.

The burn models used with isolated heating of the skin to different temperatures may be useful for the study of a number of problems of the pathogenesis of burn sickness and for developing methods of treating it experimentally.

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